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ABSTRACT

Theories concerning the relationship between language acquisition and cognitive development are examined, and implications for education are discussed. There is disagreement about the sources and processes involved in achieving linguistic performance, and in particular, determining linguistic competence. Among the many theories and modifications of theories are the following: (1) thinking is identical to speaking (Watson, 1923); (2) thinking and speaking interrelate and yield a third unique process of language (Vygotsky, 1962); (3) words and syntactic structures of a language determine how a speaker perceives the world and how he thinks (Whorf, 1956); (4) thinking is an information-processing phenomenon (Bruner, 1964); and (5) speaking is a function of thinking. Various interpretations of the last notion have been proposed by Chomsky (1965), McNeill (1966), Katz (1966), and Piaget (1967). It is suggested that while language acquisition may not be a sufficient condition for thought with respect to most cognitive functions, it may play a role in significant ways that are at present little understood. Language may well have a more significant role in the formation of thought than Piaget would allow, even though it may still not be the principal determinant of thought claimed by Bruner and Vygotsky. (SW)

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THE RELATIONSHIP BETWEEN LANGUAGE ACQUISITION AND COGNITIVE DEVELOPMENT

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The Relationship Between Language Acquisition and Cognitive Development

In the past one major indicator of the importance of an issue in education has been the extent to which there have been significant changes in the theoretic costructs which underlie that issue. This implies not merely a process of rearranging that which is known; rather, it involves the steady accumulation of substantive sources of data which delete, modify, or add to that field of knowledge and which, in turn, are capable of being applied to practical learning situations. The domains of cognitive development and language acquisition of children clearly reflect these criteria in that each independently have been the subject of extensive research. Largely through Piaget's research has the combined field of endeavour been oriented towards a denial of Noam Chomsky's (1956) original thesis, namely that the development of language struture is independent of extra-linguistic cognition. While some of Piaget's propositions have more recently come under question (Beilin et al., 1975) and there is evidence of a growing socio-linguistic tradition in language development (Flavell, 1977), the relationship between the two is still not clearly understood.

Despite greater agreement existing among researchers as to the language characteristics portrayed at different developmental levels, the means and processes by which these are acquired reflect a diversity of opinion. This paper attempts

to clarify some of these opinions by looking at their related theories and generalizations. From the position that cognition was responsible for language or vice versa has emerged a more realistic synthesis which attempts to explain this relationship.

The Emergence of Language

The period from birth to approximately three years of age is one of dramatic developmental changes. In this period the child has evolved from a position of being able to differentiate human voices from other non-human sounds to a stage of being capable of functionally using (though at times, on adult standards grammatically incorrect) complete sentences "with a vocabulary of approximately 1000 words" (DiVesta, 1974, p. 47). Qualitatively the child progresses from a pre-verbal stage to one where language begins to influence thought. Although refinements to language acquisition and its use may be a much longer process than previously thought (and some have even suggested that if it is not a life process then it continues into adolescence; see C. Chomsky, 1969), it is equally clear that by the end of the first two years, many of the abilities necessary for the decoding of complex relations between meaning and language have already developed. Lewis and Freedle 1972) claim that such a process may well have begun as early as three months of age in that the infant has already begun to actively participate in proto-dialogue routines with his/her parents. Although this would appear to be a one-way dialogue, this activity may well serve the immediate

function of providing some information about the world as well as being the foundation for cognitive structures for later language acquisition. Conversely, in instances where this is lacking, children appear to be lacking in later vacabulary range and curiosity. Lois Murphy claims that:

> "It is precisely this active exchange of play signals--in cooperation with complex pattern and sequences--which the extremely deprived baby with a destitute, exhausted mother does not have any more than do babies in some foundling homes. The discouraged, apathetic mother just sits, passively holding the baby, without face-to-face communication, much less active playful responses to the baby. The deprived baby does not have the experience which provides cognitive-motor-affective patterns for internalization to be later externalized; nor does he have the kind of experience which leads him to the realistic expectation that reaching out, exploring the outside, trying out new impacts upon it would bring pleasant results. He has less basis for conceiving of positive sequences". (1972, p. 123)

Beilin et al. (1975, p. 339) have also supported this view when they claim that:

> "The use of vocalization for the purpose of expressing intention, that is for indicating what he wishes and possibly more, sugests that the child of one year has cognitive structures and processes already developed in addition to the conative and affective states that define his motivational system."

In this period up to one year the child has moved through the infant period of cries, gasps and shrieks (to six months), the babbling period (6-9 months) and the jargon period (around nine months). Following what has been described as the "quiet period" (DiVesta, p. 47) to around one year, there is a period

of rapid single word development which in turn leads to two and three word utterences (around two years) and sentences (around three years). Given that these rapid changes do take place the problem exists of determining their relationship to cognitive development.

Theoretical approaches which relate cognition and language

Although there is fairly general agreement about the active, creative role played by the child in acquiring language, there is far less agreement among writers about the sources and processes involved in achieving linguistic performance, and in particular, determining linguistic competence.

At least four major theories have tended to dominate the explanations connecting language with cognition. The first of these asserted that thinking was identical to speaking. J.B. Watson (1923) argued that speaking was identical to thinking aloud and that many people--particularly children-speak their thoughts aloud, recite instructions verbally and often verbalize their questions and problem-solving strategies. While there is sufficient evidence to suggest that one can speak without thinking and conversely think without speaking, Vygotsky's (1962) revision of this theory has received wider support. In this view he has proposed that the two--speaking and thinking--develop as two separate or parallel processes which become interrelated when a word, or an element of the speaking system, becomes associated with a concept or element of the thinking system. The interrelationship of these two processes yields a third unique process--that of language. In

terms of child development, this implies that the child's early speaking is not rational nor his/her thinking verbal. However beyond the age of two years greater convergence between the two takes place and at this stage the third process is said to emerge. Vygotsky's major contribution in this field focuses on what he calls "inner-speech"--speech which is internalized and has the function of self-guidance. In contrast to Piaget's elaborate proposals on the egocentric speech of children which is highlighted in the pre-operational state of development (between pre-social and social speech), Vygotsky argues that egocentric speech improves with age as it becomes better and better adapted to its function. In this view, egocentric speech does not indicate a lack of intent to communicate nor a lack of awareness of the listener's intent; rather, with development vocalization disappears and egocentric speech goes 'underground' to become inner speech. Although it has generally been accepted that Piaget's interpretation of egocentricism (Piaget, 1955) has had wider acceptance in it's power to explain a given situation, greater credence may well be given to Vygotsky's viewpoint as further research is undertaken in this area. This would seem likely to be so as more evidence becomes available which shows that young children can adapt their communication to the listener's situation and needs (see Maratsos, 1973).

Flavell (1977) has suggested that there may well be three factors in earlier experiments which encouraged egocentricism. Firstly, the sheer information processing demands of earlier

experiments were greater and may have encouraged unrealistic processing loads to be made on children; secondly, more natural communication situations have been used in more recent studies and thirdly, metalanguage (the ability to be aware of and reflect upon language) may have been impeded by novel or unfamiliar situations of the earlier tradition.

An extension of Vygotsky's view, namely that the words an individual knows influences his/her verbal thinking, has been more widely interpreted into cultures in general. In this tradition, it is believed that the words and syntactic structures of a language determines how a speaker perceives the world, and hence thinks (Whorf, 1956). This view was supported by Sapir (1958, p. 162) when he stated:

> "...that the 'real world' is to a large extent unconsciously built up on the language habits of the group."

While Whorf proposed a far more deterministic role for language, his argument tends to be circular and unconvincing. Dale (1972, p. 204) has highlighted the fallacy in this argument when he criticizes that it proposes that

> "...all higher levels of thinking are dependent on language...and since languages differ in the way in which they catagorize experiences, they differ in their ability to encourage higher levels of thinking."

These proposals have been criticized by several writers, including Lenneberg and Roberts (1956) and Fishman (1970). In general it is argued that despite a language lacking specific words, this does not mean that these concepts are not thought about nor necessarily that a combination of words cannot

explain as well (if not more satisfactorily) that semantic meaning of a single word. Although it is likely that this

> "...does entail...that speakers of languages lacking such words will have difficulty in recalling the concepts because they have less efficient means for coding and storing them" (Mosenthal, 1974, pp. 307-308),

it has also been suggested that

> "The visual-verbal synesthetic relationship characteristic of our own language/culture community are shared by people who speak different languages and enjoy different cultures" (Osgood, 1960, p. 146).

Two modifications to the Whorfian hypothesis have been proposed by Carroll (1958, p. 33) and Luria (see DiVesta, 1974, p. 32). Carroll has suggested that language is a lattice through which reality is filtered.

> "It (the lattice-theory) says that language structure is like a lattice or a screen through which we see the world of our experience. This lattice, as it were, may obscure little bits of our experience, but is lets through the rest in larger or smaller hunks, perhaps clarifying some parts, clouding other parts and suggesting a larger pattern of still another. All the while, however, we see the pattern of the whole and are as little bothered by the lattice as if it were a screen installed on our front porch...We are predisposed to notice or pay attention to certain discriminations and neglect others, even though those other discriminations are possible for us to make and are capable of being elevated into potency under suitable conditions or reinforcement".

In contrast, A.R. Luria's work on the directive function of language (in terms of its ability to control motor behaviour) has focused on the developing interaction of the two

signaling systems--the non-verbal, and the later system, the verbal.

The third major theory on the connection between language and cognition has probably been the most influential of all. This interpretation stems from the notion that speaking is a function of thinking. However even within this school of thought there are varying interpretations as to the degree and extent of the innate nature of language. Chomsky (1965), McNeill (1966) and Katz (1966) all believed that humans possess an innate capacity. This interpretation is heavily dependent on accepting the premise that certain linguistic universals form the internal structure of a language acquisition device (L.A.D.) which governs the formal acquisition process. The Piagetian view (1967) differs from these in that he maintains that language is determined by the developmental level of the child's non-verbal logical structures. These structures refer to the child's ability to translate reality into symbolic propositions and, in turn, to see and alter these propositions. As such linguistic structures are developed at the same time as other symbolic schemes, particularly within the framework of the sensory-motor state. In this state the child has various kinds of mechanisms (including play, deferred imitation and the beginnings of language) all of which enable the individual to represent elements of organized thought simultaneously. However, the important feature of Piaget's theory is that the rudiments of intelligent behaviour evolve in the sensory-motor state before language develops. Piaget writes (1967, p. 11):

> "Intelligence actually appears well before language, that is to say, well before internal thought, which pre-supposes the use of verbal signs (internalized language). It is entirely practical intelligence based on the manipulation of objects; in place of words and concepts it uses percepts and movements organized into 'action schema'. For example, to grab a stick in order to draw up a remote object is an act of intelligence (and a fairly late developing one at that, about eighteen months). Here, an instrument, the means to an end, is coordinated with a pre-established goal...Many other examples could be cited."

Piaget and Inhelder (1969, p. 86) cite two types of studies that support their contention that language is neither a necessary nor sufficient condition initially to ensure the development of logical thought. Studies on deaf mutes show that they develop logical thought in the same sequential steps as normal children, but with a 1-2 years delay in some operations. Likewise studies of blind children with normal verbal development demonstrate longer delays of up to four years on the same tasks. However, once there is the emergence of verbal behaviour in a child, there is a rapid parallel development of conceptual abilities since language and representation can jointly proceed more rapidly than sensory-motor operations alone. Sinclair de Zwart (1969) has also examined the extent to which language and thinking are related by studying the verbal capacities of children using comparative terms. She found that even though the three groups of children--conservers, non-conservers and those in the transition--could understand the task, only the former group used comparative terms. Sinclair de Zwart concluded from this (and similar

experiments) that thinking dictates the development of language. Olson's study (1970) involving instruction in the drawing of diagonals tends to re-affirm this view. In contrast to this, Bloom (1970) found that there were instances where the child's language with temporal adverbs (like today and tomorrow) was more mature than the underlying cognitive function. However, in general it would seem that:

> "language learning at best contributes indirectly to the acquisition of conservation in that it helps the child to focus on relevant dimensions of the task situation". (Dale, 1972, p. 234)

Even then it is likely that the ability to consciously use language for many purposes simultaneously (as cues for memory classification, storage and retrieval) does not emerge until around the age of 6-7 years.

Slobin (1970), Lenneberg (1969) and Nelson (1975) all share the Piagetian view. Slobin (p. 369-370) has described the development of language as:

> "The child, equipped with an inherent definition of the general structure and function of language, goes about finding means for the expression of these intentions by actively attempting to understand speech. That is to say, he must have preliminary internal structures for the assimilation of both linguistic and non-linguistic input. He scans linguistic input to discover meaning, guided by certain ideas about language, by general cognitive-perceptual strategies and by processing limitations imposed by the constraints of operative memory. As in all of cognitive development this acquisition process involves the asimilation of information to existing structures, and the accommodation of those structures to new input. The speech perception strategies engender the formation

> of rules for speech production. Inner linguistic structures change with age as computation and storage space increase, as increasing understanding of linguistic intentions leads the child into the realms of formal complexity, and as internal structures are interrelated and re-organized in accordance with general principles of cognitive organization. All of these factors are cognitive prerequisites for the development of grammer."

A synthesis of Whorf's and Piaget's position has been proposed by Bruner (1964). Language, it is argued, is viewed as a liberating force for human reasoning, since the mind is freed from the immediate presence of reality.

> "In effect, language provides a means, not only for representing experience but also for transforming it...Once the child has succeeded in internalizing language as a cognitive instrument, it becomes possible for him to represent and systematically transform the regularities of experience with far greater flexibility than before". (Bruner, 1964).

The Brunerian view of thinking regards it as an information-procesing phenomenon. Bruner's modes of representation are seen as hierarchical in that each forms the basis for symbolic representation. While all three modes are in varying degrees available throughout life, language has assumed the dominant mode by the formal operations stage. Thinking is perceived as involving a successive mastery of the three forms of representation (enactive, iconic and symbolic) along with their partial transition into each other. Here representation is seen as being necessary but not the main determinate for thinking. Rather the significant feature of thinking involves how information is organized or integrated. Language is seen

as the sharpener of representation in that once the child is freed from the constraints of perception he/she can apply that language to a situation and arrive at judgments.

A Shift in Emphasis

Although a definitive single answer to explain this connection between language and cognition is not possible, there is not only more agreement about the individual processes, but as an outcome of this, the likelihood that much greater emphasis must be given to their distinctive aspects. It is now generally accepted that children learn language tacitly (including knowledge of words and grammatical meanings) at the same time as they are developing knowledge about the world in general. This implicit knowledge of language rules and appropriate words is evident before the age of five years, even though the child may be unable to make explicit the reasons for a particular rule (Whorf, 1956; Messer, 1967; Fox and Zidonis, 1975). A similar tacit knowledge is apparent when children begin to write or represent words with letters. Read (1971) found that the spontaneous spelling of pre-school and kindergarten children revealed a common system that was not adult-like in formation. This type of invented language gives further support for the view that the child plays an active role in forming hunches about language. Carol Chomsky (1975, p. 36) supported this view when she stated:

> "...Many Fives and Sixes are capable of composing sentences made up of invented spellings, they just use letters according to their names and sounds,

> putting down words as they hear them and in the process, carrying out a splendid phonetic analysis."

Such an idea also highlights the individual nature of language acquisition as the child attempts to acquire "meaning potential" (Halliday, 1975). In this endeavour, the child is guided by both the verbal and non-verbal behaviours of those who communicate and the individual child's knowledge about the nature of objects and events in the world. Macnamara (1972) and others like Clark (1973) have suggested that the infant learns language by first determining independently of language the meaning that the speaker is trying to convey. Having learned an association, the child is then in a position to apply and refine its application in language. In this process it has been suggested that the child uses certain strategies--linguistic and non-linguistic--to break the code. Gleason (1967, p. 8) has suggested that:

> "...in listening to us, the child (first, second and third graders) attended to the sense of what we said and not the form. And the plurals and past tenses they offered were products of their own linguistic systems and not imitations of us."

It is also apparent that these strategies are not limited to the initial stages of language learning. The inability to learn certain relational terms until approximately 7-8 years of age appears related to the child lacking certain cognitive abilities until this age.

While there is ample evidence that children do not learn language solely by imitation (Brown, 1973; Cazden, 1972); Chomsky, 1968), it is likely that as an accommodative strategy

it has been under-rated. In her analysis of the first fifty words learned, Katherine Nelson (1975) reported that spontaneous, partial imitation of words occurred frequently, but that

> "...some minimal adequacy in vocabulary acquisition precedes the general imitative responses to new words. The more words that a child has above a minimum level, the more likely he is to imitate old or new ones. No evidence was found of a gradual shift or a period of imitative practice prior to rapid word acquisition."

Further refinement to concept naming and understanding seems likely to be determined by the type of speech and feedback provided by parents. Although Cazden (1972, p. 6) has claimed that

> "neither correction of immmature forms nor reinforcement of mature forms (of language) occurs with sufficience frequency to be a potent force",

repetitions, redundancy and non-verbal communication has been found to abound in speech directed towards children (Broen, 1972; Phillips, 1973). These devices, together with others like higher pitch may be critical in getting the child's attention and maintaining interaction. A great deal of explicit information aobut the segmentation of speech and about syntactic relations may well be made available to the child in this way. In general it appears that there is a high degree of correlation between the complexity of adult utterances directed to a child and the complexity of child utterances themselves (Farwell, 1973).

In stressing that speech must be analyzed in terms of the context in which it is spoken and the ensuing research associated with this viewpoint, more fundamental questions have been raised against the Piagetian theory. Not only have Bloom (1974) and Brown (1973) disagreed with the view that first words function as halophrases ('expressing a possible action' and 'action judgment') but Bloom (1970) has argued that pivot-grammer is insufficient to explain two and three word utterances. Bloom has argued that grammatical relations were not present in her subjects' grammer from the beginning.

> "Children under study did not express all possible combinations of subject-verb-object...and there appeared to be individual differencesin the strategies used in acquiring linguistic structures."

Increasingly more are beginning to propose that the basic prerequisite of language learning is conceptualization (Lenneberg, 1967; Nelson, 1975; Beilin, 1975). Increasingly it is recognized that one's philosophy about how language is acquired must give consideration to other, broader issues. Nelson asserts that the child has a set of strategies available at the outset:

> "Which will be used depends on the point in development, cognitive organization, language function hypothesis, strategies used by the mother and the cognitive style of the child...These processes (strategies) are viewed as processing mediators between the environment and internal structure". (p. 159)

Thus a child who is more advanced in conceptualizaiton will be more advanced in language. Conversely, children who are not inherently slow learners may be slow in language due to

deviant early conceptual systems. Such a position is further complicated by the evident sex differences in language development wherein boys, in all aspects, lag behind girls (Harris, 1974). In general this view supports the constructive nature of the acquisition process--a progressive construction of language and cognition, parts of which are achieved in an earlier period. What is increasingly denied is that the issue is one of either cognition or language exerting predominance, one over the other. Rather, language has come to be seen as possessing properies of its own that are at least partially independnt of logical and other cognitive systems. Sufficient research evidence exists to show that there are instances where language is superior to the underlying cognition, whereas in other instances, the use of language is deficient and/or overgeneralized. The fundamental relations between these systems are not direct but appear to be mediated through a common, abstract system of relations and structures.

Several studies, including that by Weil (1970) have shown the limited effectiveness of verbal training on subjects lacking in an available cognitive structure. In this instance only approximately 20% of first and second graders profited from the language training, whereas almost all of the nineth and eleventh graders did. However,

> "while the limited effectiveness of verbal instruction on subjects lacking in an available cognitive operational structure is consistent with our earlier studies...at the same time, the very fact that verbal training could affect subjects' performance...indicated that language can play a role in cognitive development."

Thus, while language acquisition may not be a sufficient condition for thought with respect to most cognitive functions, it may play a role in significant ways that are at present little understood. Language may well have a more significant role in the formation of thought than Piaget would allow, even though it may still not be the principal determinant of thought claimed by Bruner and Vygotsky.

Implications for Education

Assuming that the development of thinking is a significant objective sought by schools, some educational implications can be derived from a study of the connection of these two processes under consideration. Firstly, it would seem that the identification of both meaning and grammar of the child's utterances is heavily dependent on relating these to the context in which they are expressed. Understanding the context in which language is expressed not only affects how a child talks (as reflected in dialect variations) but when and for what purpose language is used. Educationally this suggests that teachers must be conscious of not perpetuating a language or language experiences which are artificial to the child. While this does not imply that a laissez-faire attitude should be taken to language, it does suggest that greater concern should be given to the major objectives of language--simplicity and clarity of expression, confidence in one's ability to communicate and respecting the ideas of others as expressed in language.

Secondly, recognition must be given to the view that while language is an important medium of instruction, its use is limited to aspects which the child can understand. In many instances language may be less suitable as the medium through which to encourage conceptualization. Language as the means of instruction for pre-operational children would appear to be less successful and appropriate compared to other forms of representation. Although many writers have suggested that language should be the mode of instruction following the transition from pre-operation to concrete thinking, it may well be that language is a less effective instructional tool in the elementary school than are other combinations.

Thirdly, even though children appear to acquire language competencies implicitly, it cannot be assumed that they share the same interpretation as their teacher. This implies that sufficient verbal interaction must be provided in learning situations--not only to clarify meanings but to provide the child with opportunities to practice skills. If such practice is provided in a non-anxious atmosphere, teachers should be able to determine more clearly the distinction between language performance and competence. This means that teachers should be prepared to construct learning experiences which sample different kinds of language skills--imitation, comprehension and verbal production.

Since language is largely determined prior to the commencement of school, the function of the school must be predominantly one of enrichment. If education is to be a

dynamic, interesting process it needs to incorporate the active properties of thinking, the embodiment of materials to fit the child's existing frame of reference and the purposes which speaking serves.

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